

## Module 2 - To Err is Human

ME3023 - Measurements in Mechanical Systems

Mechanical Engineering  
Tennessee Technological University

### Topic 3 - Repeatability and Testing

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- Instrument Repeatability
- Conditions for Repeatability
- Reproducibility and Instrument Uncertainty

# Instrument Repeatability

“The ability of a measurement system to indicate the same value on repeated but independent application of the same input provides a measure of the instrument **repeatability**. Specific claims of **repeatability** are based on multiple calibration tests (replication) performed within a given lab on the particular unit.”

$$\%u_{R_{max}} = \frac{2s_x}{r_0} \times 100$$

Text: Theory and Design of Mech. Meas.

# Conditions for Repeatability

The following conditions need to be fulfilled in the establishment of repeatability:

- the same experimental tools
- the same observer
- the same measuring instrument, used under the same conditions
- the same location
- repetition over a short period of time.
- same objectives

Text: Wikipedia(NIST)

# Reproducibility and Instrument Uncertainty

“The term **reproducibility**, when reported in instrument specifications, refers to the closeness of agreement in results obtained from duplicate tests carried out under similar conditions of measurement ...

... The term **instrument precision**, when reported in instrument specifications, refers to a random uncertainty based on the results of separate repeatability tests.”

Text: Theory and Design of Mech. Meas.